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EFFECT OF DIFFERENT GROWING MEDIA ON QUALITY, GROWTH AND YIELD OF BELL PEPPER (*CAPSICUM ANNUUM VAR. GROSSUM*) UNDER SHADE HOUSE CONDITIONS

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ABSTRACT

This study was conducted to determine the effect of different growing media on quality, growth and yield of bell pepper (*capsicum annuum var.grossum*) under shade house condition. Seven types of growing media were selected viz., cocopeat, rice husk, sawdust, Cocopeat + vermicompost (1:1), Rice husk + vermicompost (1:1), Sawdust + vermicompost (1:1) and sandy loam soil and two level of drip irrigation based on ET (evapotranspiration) requirement i.e. at 100% ET and 80% ET. The crop was assessed for mean performance in respect of quality characters viz. fruit length, fruit width, rind thickness, TSS and chlorophyll, these are directly affected to yield of the bell pepper in soilless media. The best in terms of all aspect of growth was observed in treatment with sandy loam soil. The highest yield was observed in sandy loam soil (88.62 t ha^{-1}) and lowest recorded in saw dust (20.87 t ha^{-1}).

KEYWORDS: Quality Parameter, Drip Irrigation, Soilless Media and Yield Parameter

INTRODUCTION

Soilless culture as a crop production system has been used around the world for centuries and used in protected agriculture to improve control over the growing environment and to avoid uncertainties in the water and nutrient status of the soil. Soilless culture offers an alternative to soil culture when serious soil and water problems, create difficulties in traditional soil-based production. The advantages of this system is to control the supply of water and nutrients.

Pepper (*Capsicum annuum* L.) is also called as sweet pepper,green pepper. Capsicum is cultivated in most parts of the world, especially in temperate regions of Central and South America and European countries. India contributes 25 per cent of the world production. is grown in almost all parts of India. The important states growing chilli are in the order of Andhra Pradesh, Karnataka, Maharashtra, Tamilnadu and Himachal Pradesh. Karnataka stands second in production of capsicum in the country.

MATERIALS AND METHODS

Field studies were conducted in New Orchard of Main Agricultural Research Station, University of Agricultural Sciences, Raichur. The experiments were carried out in a natural ventilated shade house of 28 m length and 8 m width with center height of the shade house of 4 m. The floor area of the shade house was divided in to 28 beds each of 3 m length and 1 m width and 40 cm depth. The pits were all lined with thick polyethylene sheet on all sides and small holes are provided for drainage purpose. To analyse the effect of soilless and drip irrigation on yield and growth to bell pepper split plot design was used it involves, 2 main tteatments , seven sub treatments and two replications.

Main treatments: I_1 - 100 % ET irrigation level, I_2 - 80 % ET irrigation level

Sub treatments: Growing media *viz.*, M_1 - Cocopeat, M_2 - Rice husk, M_3 - Sawdust, M_4 - Cocopeat + vermicompost (1:1), M_5 - Rice husk + vermicompost (1:1), M_6 - Sawdust + vermicompost (1:1), M_7 - Sandy loam soil. The sandy loam soil was taken up as control treatment

QUALITY ANALYSIS

Fruit Length (mm)

Five fruits from each treatment were taken and the length was recorded from the stem end of the fruit to the distal end of the fruit using vernier caliper and mean calculated and recorded in millimetres.

Fruit Width (mm)

The width of five fruits from each treatment was recorded at the point of maximum width by using vernier caliper and mean was calculated and recorded in millimetres.

Rind Thickness (mm)

The selected fruits were sliced at the equatorial plane to measure the rind thickness with the help of vernier caliper and the mean was computed and recorded in millimetre.

Total Soluble Solids

The total soluble solids content of fruit was estimated using a refractometer and corrected to 21 $^{\circ}$C and expressed in $^{\circ}$Brix.

Chlorophyll Content

Leaf chlorophyll content was measured by a portable Spad meter. In each leaf five readings were taken the average values are recorded and expressed in percentage.

Volume of Fruit

The volume of bell pepper was determined using platform scale method. The fruit is first weighed on digital weighing balance and then forced into the water by means of a sinker rod. The second reading of the scale with the fruit submerged minus the weight of the container and water is the weight of the displaced water which will be used in the following equation (Mohsenin Nuri, 1986).

$$\text{Volume of fruit } (\text{cm}^{-3}) = \frac{\text{Weight of displaced water (g)}}{\text{Weight density of water } (\text{g cm}^{-3})}$$

Average Fruit Weight

The average fruit weights were recorded from each treatment and then mean value worked out and expressed in grams.

Yield per Plant

The weight of fruits from each plant over all the harvests was recorded and expressed in kilograms.

Yield per Hectare

Total weight of matured fruit harvested from each picking in each replication was recorded till final harvest and the total yield of fruits per hectare under different treatments computed in tonne per hectare.

RESULTS AND DISCUSSIONS

Fruit Length (mm) and Fruit Width (mm)

The results on fruit length are presented in Fig.1. Among the different media, the sandy loam soil was recorded significantly the highest fruit length (77.1 mm) and the least fruit length was observed in rice husk (26.1 mm) which was on par with that of sawdust (49.8 mm).

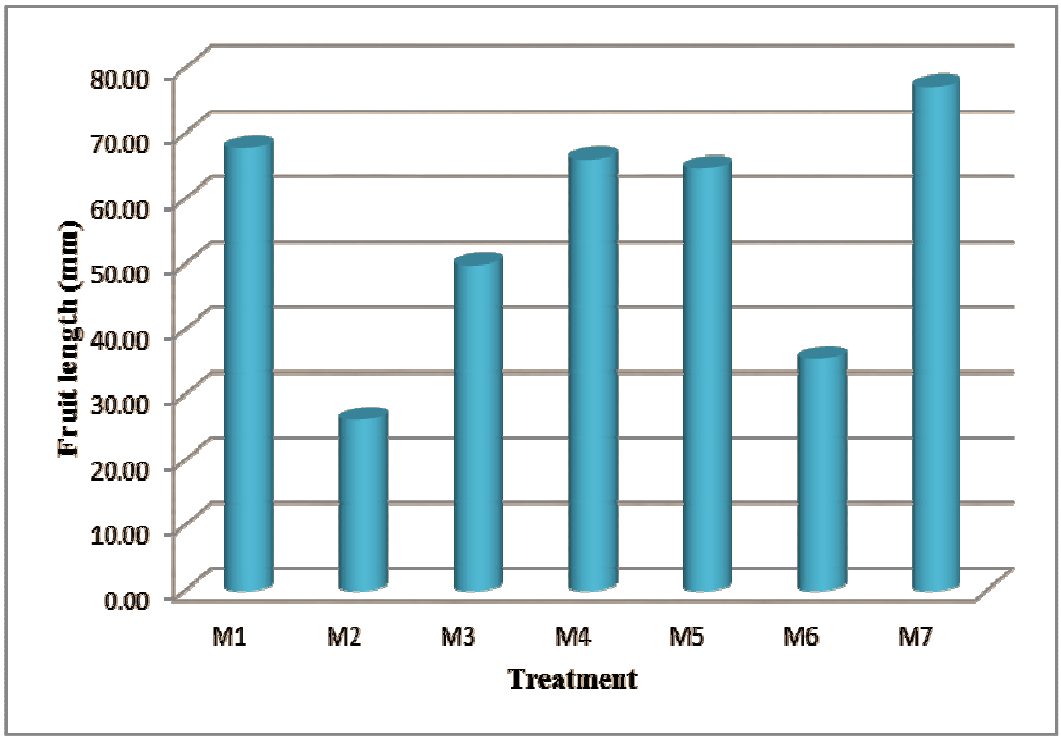

Figure 1: Effect of Soilless Media on Fruit Length for Bell Pepper

The results on fruit width are presented in Fig.2. Among the media, the sandy loam soil recorded significantly the highest fruit width (59.5 mm) and the least fruit width was observed in sawdust + vermicompost (27.4 mm) which was on par with that of rice husk (35.5 mm).

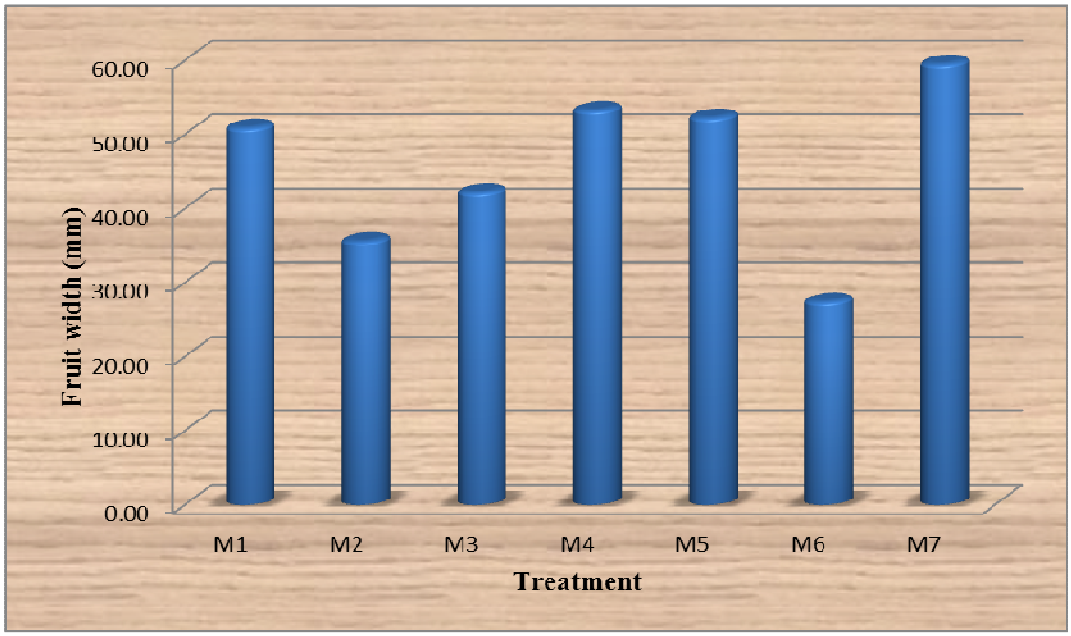

Figure 2: Effect of Soilless Media on Fruit Width for Bell Pepper

The length and breadth of fruits was higher in shade house condition. This might be due to the translocation of more photosynthesis from source to sink and also favourable microclimate that prevailed in the naturally ventilated polyhouse throughout the crop growth period. The results corroborate with the findings of (Naik, 2005).

Rind Thickness (mm)

The results obtained on rind thickness as influenced by irrigation levels and soilless growing media are presented in Table 1. Among the different drip irrigation levels, the highest rind thickness was observed in the treatment 80 per cent ET (3.0 mm), followed by 100 per cent (2.9 mm) which were statistically significant with each other. Among the media, the sandy loam soil was recorded significantly the highest rind thickness (3.7 mm) and the least was observed in rice husk (1.3 mm) which was on par with that of sawdust + vermicompost (1.8 mm).Higher rind thickness was observed in sandy loam soil which might due to bigger size of fruit under shade house. The rind thickness of fruit was positively correlated with fruit size, which is to the observation of (Naik 2005).

Volume of Fruit

The data regarding volume of fruit for different irrigation levels and soilless media are given in Table 1. Among the different drip irrigation levels, the highest volume of fruit was observed in the treatment 100 per cent ET (103.2), followed by 80 per cent (101.3) which were statistically significant different. In the sub plot the different media sandy loam soil was recorded the maximum volume of fruit (141.5) and minimum volume of fruit was found in rice husk (56.3) which were statistically on par with each other.

Result shows that fruit volume was highest in sandy loam soil and lowest in rice husk. This was due to the increased length and breadth of fruit. And also high uptake of nutrients and build-up of sufficient photosynthesis enabled the increase in size of fruits (length and breadth). Similar findings were recorded by (Kurubetta Yellavva, 2008).

Table 1: Effect of Different Drip Irrigation Levels and Growing Media on Rind Thickness (mm) and Fruit Volume (cc/Fruit)

Treatments	Rind thickness (mm)	Fruit volume (cc/fruit)
M: Drip irrigation levels		
I_1:100 % ET	2.9	103.2
I_2:80 % ET	3.0	101.3
Mean		
S.Em.±	0.009	0.084
C.D.at 5 %	0.163	1.524
S: Media		
M_1:Cocopeat	3.2	109.9
M_2:Rice husk	1.3	56.3
M_3:Sawdust	3.5	101.7
M_4:Cocopeat + Vermicompost	3.2	121.1
M_5:Rice Husk + Vermicompost	3.3	93.6
M_6:Sawdust + Vermicompost	1.8	91.6
M_7:Sandy loam soil	3.7	141.5
Mean		
S.Em.±	0.54	14.71
C.D.at 5 %	1.67	45.33
Interaction		
I × M		
S.Em.±	0.77	20.81
C.D.at 5 %	**NS**	**NS**
I at the same or different M		
S.Em.±	1.08	29.42
C.D.at 5 %	**NS**	**NS**

Total Soluble Solids (TSS)

The effect of drip irrigation levels and soilless media on TSS of bell pepper crop are presented Table 2. it can be seen that from table the treatment 100 per cent ET levels shows the highest TSS value (3.5 ºbrix) which was statistically significant difference with 80 per cent ET (3.4 ºbrix). In the sub plot the among all the media sandy loam soil recorded the maximum TSS (4.4 ºbrix) and minimum TSS was found in rice husk (1.8 ºbrix) which were statistically on par with each other. TSS content of the fruit which helped in better uptake of NPK nutrients including micronutrients which in turn influence the quality traits in capsicum. The results are in conformity with the findings of (Asano 1994) in cucumber.

Chlorophyll Content

The colour of fruit is an important determinant of the quality status of any vegetable. The chief pigment of fruits and vegetables which impart the green colour is chlorophyll. Different treatments were found to promise the effect on total chlorophyll content of bell pepper fruit. As a result, from Table 3. it is revealed that the maximum chlorophyll was recorded in sandy loam soil (68.3) and minimum in rice husk (24.7). The chlorophyll is an essential component for photosynthesis occurs in chloroplasts a green pigments in all photosynthetic plant tissues, so more chlorophyll content in plants may be attributed to more uptake of nitrogen by the plants. Similar results were found by (Malik et al. 2011).

Yield Parameter

The fruit volume and Chlorophyll play an important role in increasing the total yield in bell pepper. From the

Table .4. It can be seen that the yield was higher in sandy loam soil (88.62 t ha^{-1}) followed by cocopeat (62.00 t ha^{-1}). This may be due to maximum air temperature during the growing season which affects the substrate temperature and increasing the difference between day and night temperatures at the root zone may negatively affect the substrate yields.

Table 2: Total Soluble Solids (Percent) of Capsicum as Influenced by Different Drip Irrigation Levels and Growing Media

Treatments	TSS
M: Drip irrigation levels	
I_1:100 % ET I_2:80 % ET	3.5 3.4
Mean	
S.Em.± **C.D.at 5 %**	0.005 0.090
S: Media	
M_1:Cocopeat M_2:Rice husk M_3:Sawdust M_4:Cocopeat + Vermicompost M_5:Rice Husk + Vermicompost M_6:Sawdust + Vermicompost M_7:Sandy loam soil	4.0 1.8 3.5 4.1 3.0 3.6 4.4
Mean	
S.Em.± **C.D.at 5 %**	0.505 1.558
Interaction	
I × M S.Em.± **C.D.at 5 %**	 0.72 **NS**
I at the same or different M S.Em.± **C.D.at 5 %**	 1.01 **NS**

Table 3: Chlorophyll Content of Bell Pepper as Influenced by Different Drip Irrigation Levels and Growing Media

Treatments	Chlorophyll
M: Drip Irrigation Levels	
I_1:100 % ET I_2:80 % ET	51.4 48.3
Mean	
S.Em.± **C.D.at 5 %**	0.16 2.94
S: Media	
M_1:Cocopeat M_2:Rice husk M_3:Sawdust M_4:Cocopeat + Vermicompost M_5:Rice Husk + Vermicompost M_6:Sawdust + Vermicompost M_7:Sandy loam soil	61.7 24.7 42.1 60.4 60.5 31.1 68.3
Mean	
S.Em.± **C.D.at 5 %**	7.84 24.17
Interaction	
I × M S.Em.± **C.D.at 5 %**	11.10 **NS**
I at the same or different M S.Em.± **C.D.at 5 %**	4.64 NS

Table 4: Yield of Bell Pepper as Influenced by Different Drip Irrigation Levels and Growing Media

Treatment	Average Fruit Weight (g)	Yield Per Plant (kg)	Yield (t ha^{-1})
M: Drip irrigation levels			
I_1:100 % ET I_2:80 % ET	83.93 79.57	4.06 3.64	50.75 45.50
Mean			
S.Em.± **C.D. (5 %)**	0.15 2.72	0.01 0.32	0.31 3.98
S: Media			
M_1:Cocopeat M_2:Rice husk M_3:Sawdust M_4:Cocopeat + Vermicompost M_5:Rice Husk + Vermicompost M_6:Sawdust + Vermicompost M_7:Sandy loam soil	92.25 72.50 54.00 84.75 87.00 77.75 104.00	4.96 2.03 1.67 4.48 4.46 3.45 7.09	62.00 25.37 20.87 56.00 55.75 43.12 88.62
Mean			
S.Em.± **C.D.at 5 %**	6.54 20.18	0.02 0.45	5.29 16.32
Interaction			
I × M S.Em.± **C.D.at 5 %**	9.26 **NS**	0.42 **NS**	7.49 **NS**
I at the same or different M S.Em.± **C.D.at 5 %**	13.10 **NS**	0.60 **NS**	10.60 **NS**

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